



**ANNUAL REPORT ON THE MARKET  
FOR RGGI CO<sub>2</sub> ALLOWANCES: 2013**

**Prepared for:**

**RGGI, Inc., on behalf of the RGGI Participating States**

**Prepared By:**



May 2014

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The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort of Northeast and Mid-Atlantic states to reduce emissions of carbon dioxide (CO<sub>2</sub>) from the power sector.

RGGI, Inc. is a non-profit corporation created to provide technical and administrative services to the states participating in the Regional Greenhouse Gas Initiative.

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## I. EXECUTIVE SUMMARY

The Regional Greenhouse Gas Initiative (“RGGI”) became the first mandatory cap-and-trade program to limit CO<sub>2</sub> emissions in the United States in 2009. Electric power generators located in the states participating in RGGI are required to obtain a number of CO<sub>2</sub> allowances equal to the number of tons of CO<sub>2</sub> they emit. RGGI distributes CO<sub>2</sub> emissions allowances to the market primarily through auctions, making it distinctive among existing cap-and-trade programs. Ninety-four percent of the CO<sub>2</sub> allowances that have entered into circulation initially entered the market through one of the auctions. Through the end of 2013, RGGI has conducted 22 successful auctions, selling a total of 651 million CO<sub>2</sub> allowances for \$1.6 billion.

Following a 2012 Program Review, the Participating States announced changes to the Model Rule, including a new CO<sub>2</sub> emissions cap.<sup>1</sup> The new CO<sub>2</sub> emissions cap is 91 million tons for 2014, and will be reduced by 2.5 percent per year until it reaches approximately 78 million tons for 2020. The Model Rule also included further interim adjustments to the cap to account for the surplus of allowances from 2009 to 2013 in circulation.<sup>2</sup> Since these program adjustments were announced in February 2013, there have been significant changes in market activity which are discussed throughout this report.

This report evaluates activity in the market for RGGI CO<sub>2</sub> allowances in 2013, focusing on the following areas: allowance prices, trading and acquisition of allowances in the auctions and the secondary market, participation in the market by individual firms,<sup>3</sup> and market monitoring.

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<sup>1</sup> The new emissions cap and other updates to the Model Rule were announced on February 7, 2013. See [http://www.rggi.org/docs/PressReleases/PR130207\\_ModelRule.pdf](http://www.rggi.org/docs/PressReleases/PR130207_ModelRule.pdf). Subsequently, each of the Participating States revised its CO<sub>2</sub> Budget Trading Program to be consistent with the updated Model Rule. See [http://www.rggi.org/docs/PressReleases/PR011314\\_AuctionNotice23.pdf](http://www.rggi.org/docs/PressReleases/PR011314_AuctionNotice23.pdf).

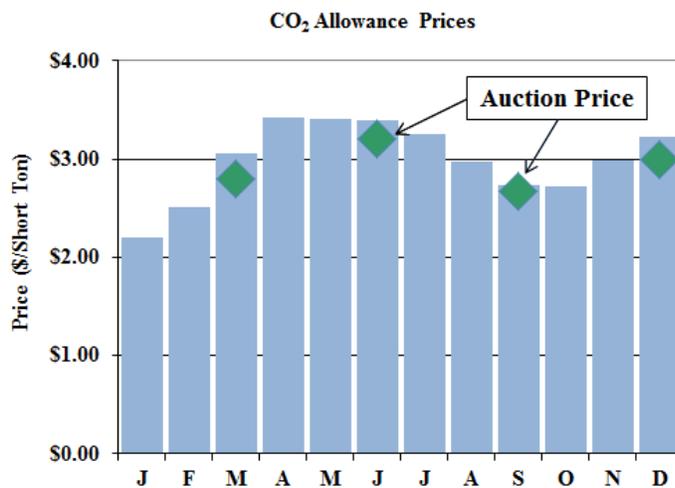
<sup>2</sup> These program changes are described in more detail in Section II.A.

<sup>3</sup> Throughout this report the term “firms” is used to refer to all participants in the CO<sub>2</sub> allowance market, including individuals.

*CO<sub>2</sub> Allowance Prices*

The average auction clearing price increased 51 percent from \$1.93 in 2012 to \$2.92 in 2013.

Secondary market prices were generally consistent with auction clearing prices, increasing



throughout the first quarter, plateauing at an average of \$3.41 in the second quarter, falling steadily during the third quarter, and rising again throughout the fourth quarter (see figure). Prices in the secondary market increased 53 percent to an average of \$3.03 in 2013.<sup>4</sup>

The demand for allowances in the auctions and in the secondary market rose considerably following the

announcement of the updated model rule in February 2013. One hundred percent of the 153 million CO<sub>2</sub> allowances offered for sale in auctions during 2013 were sold, up from 59 percent in 2012. Given the new emissions cap, firms anticipate that allowance prices will remain well above the auction reserve price (currently \$2.00) over the foreseeable future.<sup>5</sup> Furthermore, speculation that a forthcoming EPA rule will encourage participation in regional CO<sub>2</sub> cap-and-trade programs likely contributed to the increase in allowance prices in the fourth quarter.<sup>6</sup>

<sup>4</sup> Allowance prices are summarized in more detail in Section III.A.

<sup>5</sup> Auction results are summarized in Section IV.A.

<sup>6</sup> Section 111(d) of the Clean Air Act provides for the EPA to "...establish a procedure for states to submit plans containing performance standards for existing sources..." The EPA sought comment from the public on state programs to reduce emissions in September 2013. See *Considerations in the Design of a Program to Reduce Carbon Pollution from Existing Power Plants* at <http://www2.epa.gov/carbon-pollution-standards/questions-state-partners>.

Price volatility was also elevated in 2013 as secondary market prices moved substantially above the auction reserve price, and variations in the supply and demand for allowances had more impact on the market value of allowances.<sup>7</sup>

### ***Trading of CO<sub>2</sub> Allowances***

Firms initially acquire CO<sub>2</sub> allowances in the primary market, mainly by purchasing them in the quarterly auctions. Firms can also buy and sell CO<sub>2</sub> allowances in the secondary market. Secondary market activity consists mainly of trading of futures and options contracts on the public exchange and transfers of ownership recorded in COATS (“CO<sub>2</sub> Allowance Tracking System”).

Increased uncertainty about future CO<sub>2</sub> allowance prices has contributed to increased trading activity as compliance entities seek to hedge themselves and entities without compliance obligations (“investors”) take more interest in the secondary markets for allowances.<sup>8</sup>

Accordingly, the volume of futures trading totaled 76 million CO<sub>2</sub> allowances in 2013, up from just two million in 2012. Trading increased throughout 2013 and was highest in the fourth quarter.<sup>9</sup>

### ***Acquisition and Holdings of CO<sub>2</sub> Allowances***

As the private bank of surplus CO<sub>2</sub> allowances has grown during 2013, compliance entities have accumulated surplus allowances and investors have become more active in the allowance market. The number of CO<sub>2</sub> allowances in circulation increased from 161 million at the end 2012 to 319 million at the end of 2013. The share of CO<sub>2</sub> allowances held by compliance entities was 76 percent. The share of CO<sub>2</sub> allowances held by investors increased from 6 percent at the

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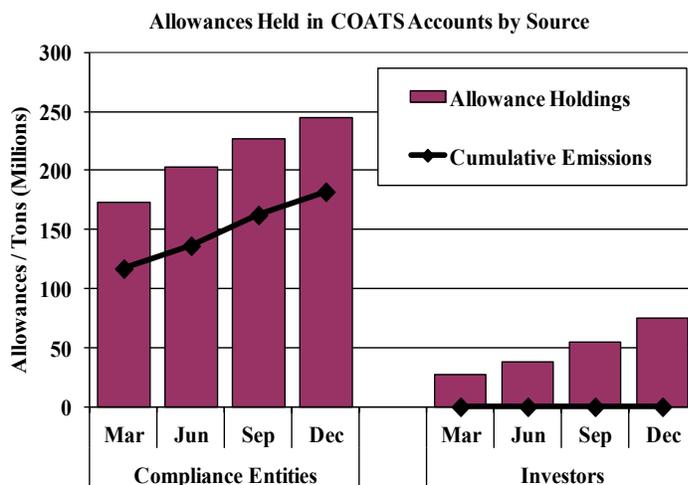
<sup>7</sup> Allowance price volatility is evaluated in Section III.B.

<sup>8</sup> Entities without compliance obligations are described as “investors” throughout this report.

<sup>9</sup> Trading volumes and open interest are summarized in Sections IV.B and IV.C.

beginning of 2013 to 24 percent at the end of the year. The share of available CO<sub>2</sub> allowances purchased by investors in the quarterly auctions increased from two percent in 2012 to 48 percent in 2013. Investors were also active in the secondary markets, particularly in the fourth quarter.

The number of CO<sub>2</sub> allowances in circulation on December 31, 2013 was 319 million, while cumulative compliance obligations for the second control period were 179 million. Therefore, the surplus number of CO<sub>2</sub> allowances at the end of 2013 was 140 million. As a result of the interim downward adjustments to the cap, the current surplus of allowances will be depleted over the remainder of the decade.



The figure below summarizes the holdings of CO<sub>2</sub> allowances at the end of each quarter in 2013 by compliance entities and investors.<sup>10</sup> As the figure shows, compliance entities held substantially more CO<sub>2</sub> allowances than needed to satisfy compliance obligations for 2012 and 2013.<sup>11</sup> Compliance entities held 244 million allowances at the end of 2013

compared to second control period emissions of 179 million. The surplus CO<sub>2</sub> allowances held by compliance entities at the end of 2013 (65 million) accounted for 46 percent of the overall private bank of surplus allowances. Thus, investors held 54 percent of the private bank of surplus CO<sub>2</sub> allowances at the end of 2013.

<sup>10</sup> Monthly totals are provided in Section IV.D.

<sup>11</sup> Although the aggregate holdings of compliance entities exceed the sum of all compliance obligations from 2012 and 2013, the holdings of some individual compliance entities do not exceed their compliance obligations.

The auctions are still the primary means by which firms acquire CO<sub>2</sub> allowances. Fifty percent of the CO<sub>2</sub> allowances in circulation at the end of 2013 were held by firms that had held them since the beginning of the year, 39 percent were held by firms that acquired them through auctions or state allocations during 2013, and 11 percent were held by firms that purchased them in the secondary market during 2013.

### ***Participation in the Market by Individual Firms***

Participation by many firms promotes competition and helps ensure that CO<sub>2</sub> allowance prices are determined efficiently. Over time, firms that need CO<sub>2</sub> allowances for compliance should be able to acquire them through the auctions and/or the secondary market, and the holdings of individual firms should be relatively consistent with their potential uses for allowances.<sup>12</sup>

The demand for CO<sub>2</sub> allowances is dispersed relatively widely across firms, inviting participation in the auctions by a large number of firms. The two largest compliance entities account for a combined 31 percent of the total projected demand, a moderate increase from 2012.

The number of auction participants increased in 2013. An average of 45 bidders participated in each of the 2013 auctions, up 53 percent from 2012. The number of compliance entities submitting bids increased from an average of 23 in 2012 to 36 in 2013, while the number of investors submitting bids increased from an average of one in 2012 to ten in 2013.

The holdings of allowances were generally distributed across firms consistent with their compliance obligations, although the significant surplus of allowances in circulation led many firms to hold significant surpluses. The top ten compliance entities accounted for 56 percent of total holdings, smaller compliance entities accounted for 21 percent, and seven investors accounted for 23 percent. These levels are consistent with competitive expectations given that

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<sup>12</sup> Participation in the auctions and the secondary market by individual firms is evaluated in Section V.

the current private bank of allowances far exceeds the compliance obligations of firms thus far in the second control period.

***Market Monitoring***

As the RGGI Market Monitor, we evaluate the conduct of market participants in the auctions and in the secondary market to identify potential anti-competitive conduct. We also assess whether the auctions were administered properly by World Energy Solutions.

In our reviews of the four auctions in 2013, we found no material concerns regarding the auction process, barriers to participation in the auctions, or the competitiveness of the results. Large numbers of firms participated in the offerings of CO<sub>2</sub> allowances. Further, we found that the auctions were administered in accordance with the noticed rules and bids received.

We find no evidence of anti-competitive conduct in the secondary market for CO<sub>2</sub> allowances, and we find that firms have generally purchased quantities of allowances that are consistent with their expected needs.

## **II. BACKGROUND ON THE CO<sub>2</sub> ALLOWANCE MARKET**

RGGI began full operation in 2009, becoming the first mandatory market-based program to limit CO<sub>2</sub> emissions in the United States. Market-based cap-and-trade programs work by setting an aggregate emissions limit for a particular class of emitters, and requiring them to acquire a number of allowances sufficient to cover their emissions. Firms that own allowances can decide whether it is more profitable to use them to cover their emissions or to sell them to an emitter that can use them more efficiently. In this manner, the goal of market-based programs is to use market forces to reduce overall emissions in the most cost-effective ways.

RGGI is a collaborative effort of Northeast and Mid-Atlantic states to reduce overall CO<sub>2</sub> emissions.<sup>13</sup> Electricity generating plants with more than 25 MW of capacity (“CO<sub>2</sub> budget sources”) must acquire a number of CO<sub>2</sub> allowances sufficient to cover their CO<sub>2</sub> emissions by the end of each control period. Firms that own budget sources (“compliance entities”) can acquire CO<sub>2</sub> allowances through a variety of means, including by purchasing them in the quarterly RGGI auctions or in the secondary market for allowances.

The market for RGGI CO<sub>2</sub> allowances has several key elements, which are discussed in this section: compliance obligations, the CO<sub>2</sub> Allowance Tracking System (“COATS”), the primary market for allowances, and the secondary market for allowances.

### **A. Regional CO<sub>2</sub> Emissions Cap**

Following a 2012 Program Review, each of the Participating States announced changes to the RGGI program, including a new RGGI CO<sub>2</sub> cap for the period from 2014 to 2020.<sup>14</sup> The new

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<sup>13</sup> The full set of rules for the RGGI program (known as the “Model Rule”) may be found at [www.rggi.org/docs/ProgramReview/\\_FinalProgramReviewMaterials/Model\\_Rule\\_FINAL.pdf](http://www.rggi.org/docs/ProgramReview/_FinalProgramReviewMaterials/Model_Rule_FINAL.pdf).

<sup>14</sup> The new emissions cap and other updates to the Model Rule were announced on February 7, 2013. See [http://www.rggi.org/docs/PressReleases/PR130207\\_ModelRule.pdf](http://www.rggi.org/docs/PressReleases/PR130207_ModelRule.pdf). Subsequently, each of the Participating States revised its CO<sub>2</sub> Budget Trading Program to be consistent with the updated Model Rule. See [http://www.rggi.org/docs/PressReleases/PR011314\\_AuctionNotice23.pdf](http://www.rggi.org/docs/PressReleases/PR011314_AuctionNotice23.pdf).

CO<sub>2</sub> cap is set at 91.0 million tons for 2014, and will be reduced by 2.5 percent per year until it reaches approximately 78.2 million tons for 2020.

The Model Rule included further adjustments to the cap to account for the surplus of allowances from allocation years 2009 to 2013 in circulation.<sup>15</sup> Although many of the CO<sub>2</sub> allowances from allocation years 2009 to 2013 were not distributed, 690 million allowances were put in circulation compared to total compliance obligations of 550 million tons for the period from 2009 to 2013.<sup>16</sup> Unused CO<sub>2</sub> allowances can be “banked” by the holder, so the private bank of allowances exceeded the total expected compliance obligations by 140 million tons at the beginning of 2014. Consequently, two interim adjustments for 2009-2013 banked allowances are being used to adjust the RGGI CO<sub>2</sub> cap to account for the private bank that was anticipated to accumulate by the first quarter of 2014.

*First Control Period Interim Adjustment for Banked Allowances (“FCPIABA”)* – This is a reduction in the number of CO<sub>2</sub> allowances that will be sold over the seven-year period from 2014 to 2020. The amount of the reduction is equal to the private bank of first control period CO<sub>2</sub> allowances (i.e., allocation years 2009, 2010, and 2011) that were in circulation after compliance was completed for the first control period. The FCPIABA is approximately 8.2 million CO<sub>2</sub> allowances per year from 2014 to 2020.<sup>17</sup>

*Second Control Period Interim Adjustment for Banked Allowances (“SCPIABA”)* – This is a reduction in the number of CO<sub>2</sub> allowances that will be sold over the six-year period from 2015 to 2020. The amount of the reduction is equal to the private bank of 2012 and 2013 allocation

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<sup>15</sup> New Jersey left the RGGI program at the end of the first control period, which was from 2009 to 2011. So, the emissions cap was reduced from 188 million tons to 165 million tons in 2012 to account for the departure of New Jersey.

<sup>16</sup> This includes 53 million tons of compliance obligations for New Jersey from 2009 to 2011.

<sup>17</sup> See [www.rggi.org/docs/SCPIABA.pdf](http://www.rggi.org/docs/SCPIABA.pdf).

year allowances that are in excess of 2012 and 2013 emissions. The SCPIABA is approximately 13.7 million CO<sub>2</sub> allowances per year from 2015 to 2020.<sup>18</sup>

Given the new CO<sub>2</sub> cap and the interim control period adjustments for banked allowances, the adjusted CO<sub>2</sub> cap will fall from approximately 82.8 million in 2014 to 56.3 million in 2020. Overall, the number of CO<sub>2</sub> allowances distributed for the adjusted CO<sub>2</sub> cap for the period from 2014 to 2020 will be approximately 449 million. These will be in addition to the 140 million surplus allowances already in circulation.

### **B. Compliance Obligations**

CO<sub>2</sub> budget sources are fossil fuel-fired electricity generating plants with greater than 25 MW of capacity. Shortly after the end of each control period, compliance entities must submit a sufficient number of CO<sub>2</sub> allowances to cover their CO<sub>2</sub> emissions during the control period. The first control period ran from January 1, 2009 to December 31, 2011, and the second control period will run from January 1, 2012 to December 31, 2014.

In 2012, RGGI completed the compliance process for the first control period. By January 30, compliance entities were required to submit all CO<sub>2</sub> emissions data for CO<sub>2</sub> budget sources for the first control period to the Environmental Protection Agency's ("EPA's") Clean Air Markets Division ("CAMD") Business System. By March 1, the Compliance Account for each CO<sub>2</sub> budget source was required to hold a number of first control period CO<sub>2</sub> allowances (not including any CO<sub>2</sub> allowances surrendered previously) sufficient to satisfy its compliance obligation. Each CO<sub>2</sub> budget source was also required to submit a Compliance Certification Report certifying that it was in compliance with its state's CO<sub>2</sub> Budget Trading Program.<sup>19</sup>

### **C. CO<sub>2</sub> Allowance Tracking System ("COATS")**

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<sup>18</sup> *ibid.*

<sup>19</sup> The Compliance Summary for the First Control Period may be found at <https://rggi-coats.org/eats/rggi/Docs/ArchivedSourceSubmittedComplianceReport.pdf>.

COATS is the registry for RGGI CO<sub>2</sub> allowances. Each CO<sub>2</sub> allowance has a unique serial number and can be used to satisfy one short ton of compliance obligations. When firms trade CO<sub>2</sub> allowances in the secondary market, the seller must record the transfer of ownership in COATS before the buyer is recognized as the owner.<sup>20</sup>

#### **D. Primary Market for RGGI CO<sub>2</sub> Allowances**

The participating states have taken the approach of using auctions rather than free allocations as the primary means for distributing RGGI CO<sub>2</sub> allowances to the market. Accordingly, the primary market for CO<sub>2</sub> allowances consists mainly of the quarterly auctions. Through the end of 2013, 94 percent of the CO<sub>2</sub> allowances that have been put into circulation initially entered the market through one of the 22 auctions that have taken place on a quarterly basis since September 2008. The remaining six percent of CO<sub>2</sub> allowances have been placed in circulation through one of the following means.

*Offset Projects* – Additional CO<sub>2</sub> allowances can also be awarded for approved CO<sub>2</sub> emissions offset projects (project-based greenhouse gas emissions reductions or carbon sequestration that occurs outside the capped electricity generation sector), although no such allowances have been awarded thus far.

*Early Reduction Allowances* – In 2009, there was a one-time award by certain participating states of 2.4 million early reduction allowances (ERAs), which were awarded for qualifying CO<sub>2</sub> emissions reductions achieved at CO<sub>2</sub> budget sources during 2006 through 2008, prior to the start of the first control period.

*Allocations & Sales by States* – Approximately 29.7 million CO<sub>2</sub> allowances for the first control period were allocated by individual states through either fixed-price sales or free allocations.

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<sup>20</sup> Public information related to the COATS registry may be found at [http://www.rggi.org/market/tracking/public\\_reporting](http://www.rggi.org/market/tracking/public_reporting).

Approximately 7.7 million CO<sub>2</sub> allowances for the second control period have been allocated by individual states.

Regardless of how CO<sub>2</sub> allowances initially enter the market, they can be traded to other firms in the secondary market.

### **E. Secondary Market for RGGI CO<sub>2</sub> Allowances**

The secondary market is important for several reasons. First, it gives a firm the ability to obtain CO<sub>2</sub> allowances at any time during the three months between the RGGI auctions. Second, it provides a way for a firm to protect itself against the potential volatility of future auction clearing prices. Third, it provides price signals that can assist a firm in making investment decisions in markets affected by the cost of RGGI compliance.

The secondary market for RGGI CO<sub>2</sub> allowances comprises the trading of physical allowances and financial derivatives, such as futures, forwards, and options contracts. A physical CO<sub>2</sub> allowance trade occurs when the parties to the transaction register the transfer of ownership in COATS. Financial derivatives include any contracts whereby parties agree to exchange funds and/or allowances at some future date, depending in many cases on factors such as the price of allowances at some future date. Many financial derivatives eventually result in the transfer of physical CO<sub>2</sub> allowances (i.e., the transfer is registered in COATS), but this may occur months or years after the parties enter into a financial transaction. These include the following types of transactions:

- *Futures* – Under these contracts, two parties agree to exchange a fixed number of CO<sub>2</sub> allowances of a certain vintage year at a particular price at a specific point in the future (called the “delivery month”). At the end of the delivery month, the contracted number of CO<sub>2</sub> allowances must be physically transferred to the buyer’s account in the COATS registry and funds must be transferred to the seller. The vintage year refers to the allocation year of the CO<sub>2</sub> allowance that is to be transferred. One standard futures contract equals 1,000 RGGI CO<sub>2</sub> allowances.
- *Forwards* – These are like futures contracts, but a forward contract typically requires that all financial settlement occur at expiration.

- *Call Options* – Call options give the purchaser the option to buy a fixed number of CO<sub>2</sub> allowances of a certain vintage year at a particular strike price at any time prior to the expiration date. For example, suppose a firm holds a call option with \$5 strike price and December 2013 expiration date. If the price of the corresponding forward contract rose to \$5.75, the firm could exercise the option to buy CO<sub>2</sub> allowances at \$5 and immediately sell them at \$5.75. Alternatively, if the price of the forward contract stayed below \$5, the firm would let the option expire without exercising it. One standard options contract can be exercised for 1,000 RGGI allowances.
- *Put Options* – Put options are similar to call options but they give the purchaser the option to *sell* a certain number of CO<sub>2</sub> allowances of a particular vintage year at a specified strike price any time prior to the expiration date.

Futures, forwards, and options contracts allow firms to manage risks associated with unforeseen swings in commodity prices. Futures and forwards allow firms to lock-in the prices of future purchases or sales. Options allow firms to limit their exposure to price volatility. Call options protect the purchaser if the price of the commodity increases, while put options protect the purchaser if the price of the commodity decreases. Although options provide less certainty than futures and forward contracts, they usually require less financial security, which could make them more attractive to some firms.

The terms of futures, forward, and option contracts vary in the degree to which they are standardized. “Exchange-traded” contracts typically have the most standardized provisions, while the term “over-the-counter” (“OTC”) is applied to contracts with less standardized provisions. However, OTC contracts, once entered into, are often settled through a clearinghouse in order to protect the parties from the risk that the counterparty defaults.

The amount of *open interest* is the net amount of futures, forwards, or options contracts that have been traded for a contract with a particular set of specifications (i.e., vintage year, delivery month, etc.), but have not reached the time of delivery, expired, or been exercised. For example, if Firm A sells 100 contracts of a particular type to Firm B, Firm A will have a short position of 100 contracts, Firm B will have a long position of 100 contracts, and the total open interest for the particular type of contract will be 100 contracts. Hence, the total open interest can be

determined by summing across all of the long positions of market participants or by summing across all of the short positions.

### III. CO<sub>2</sub> ALLOWANCE PRICES

The market for RGGI CO<sub>2</sub> allowances consists primarily of purchases in the quarterly auctions and trading of allowances and allowance futures and options contracts in the secondary market. The clearing prices from quarterly auctions provide public information about the market value of CO<sub>2</sub> allowances four times per year, while the prices of futures and forwards trades on public exchanges and transaction prices recorded in COATS provide price information more frequently. This section of the report evaluates prices in the markets for RGGI CO<sub>2</sub> allowances in 2013.

Key observations regarding RGGI CO<sub>2</sub> allowance prices:

- *Auction Clearing Prices* – The average auction clearing price increased 51 percent from \$1.93 in 2012 to \$2.92 in 2013. In 2012, each of the quarterly auctions cleared at the reserve price. In 2013, the demand for CO<sub>2</sub> allowances in the auctions was considerably higher following the announcement of the updated Model Rule in February. Auction prices peaked in the second quarter when Auction 20 cleared at \$3.21 on June 5.
- *Price Trends in the Secondary Market* – Secondary market prices were generally consistent with auction clearing prices, increasing throughout the first quarter, plateauing at an annual high in the second quarter, falling steadily during the third quarter, and rising again throughout the fourth quarter. The upward price movements were driven partly by: (i) the anticipated changes in the CO<sub>2</sub> emissions cap and (ii) speculation that a forthcoming EPA rule will encourage participation in regional cap-and-trade programs.<sup>21</sup> Futures prices averaged \$3.03 for the year, an increase of 53 percent from 2012, and they peaked in the second quarter of 2013 when the average price was \$3.41.
- *CO<sub>2</sub> Emissions Cap and Price Volatility* – Price volatility was very low from 2010 to 2012 when there was a substantial surplus of CO<sub>2</sub> allowances and prices remained very close to the auction reserve price.<sup>22</sup> After the announcement of planned changes in the annual CO<sub>2</sub> emissions cap, allowance prices became more volatile as variations in the supply and demand for allowances had more impact on the market value of allowances.

#### A. Prices in the Auctions and the Secondary Market

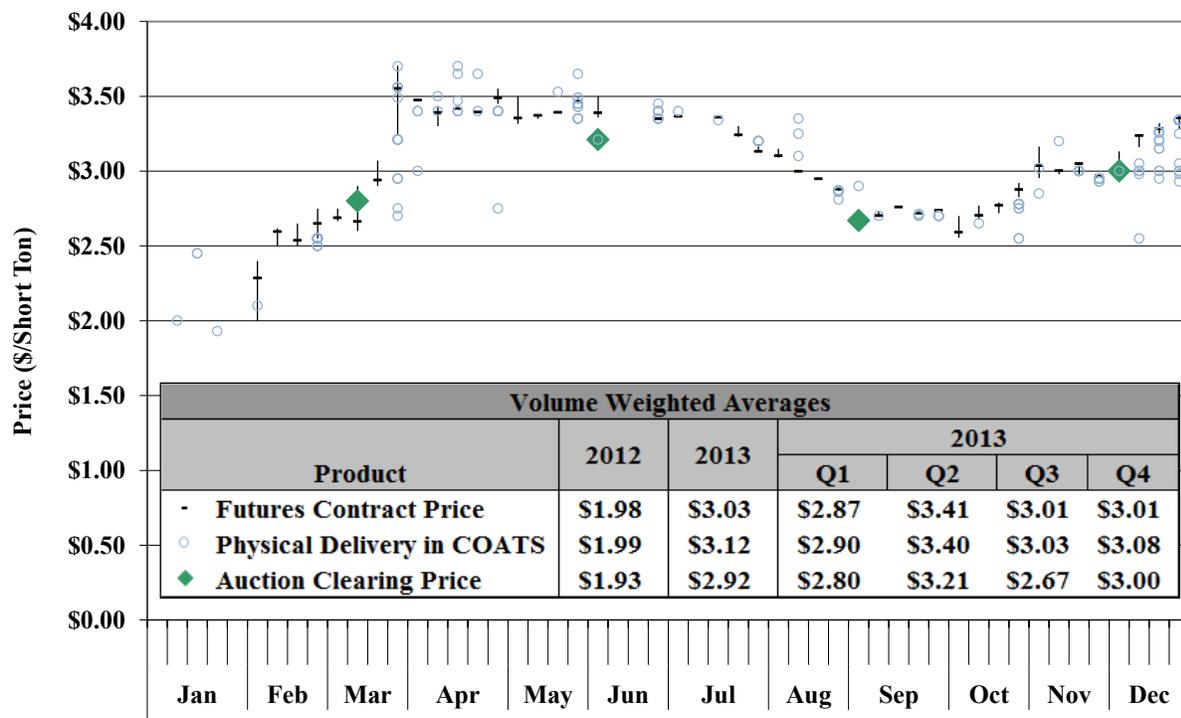
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<sup>21</sup> Many interested parties submitted comments recommending that the EPA allow states to use regional programs to reduce CO<sub>2</sub> emissions under Clean Air Act section 111(d).

<sup>22</sup> Allowances are never sold for less than the auction reserve price, so it functions as a price floor for the market.

Figure 1 summarizes prices in the auctions and in the secondary market on a weekly basis from January to December 2013. Futures contract prices are summarized for each week by a black vertical line from the minimum transaction price to the maximum transaction price in the week and by a black horizontal tick mark at the volume-weighted average price for each week. The volume-weighted average price of physical deliveries of CO<sub>2</sub> allowances recorded in COATS are shown by blue circles for each day when a transaction took place at a price that was recorded by the transacting parties.<sup>23</sup> The figure also shows the auction clearing prices of CO<sub>2</sub> allowances in the four quarterly auctions held during 2013, which are represented by the green diamonds.

**Figure 1: CO<sub>2</sub> Allowance Prices in the Auctions and Secondary Market 2013**



Observations regarding prices in auctions and the secondary market:

<sup>23</sup> Parties must report the transaction price if there is an underlying financial transaction related to the transfer.

- *General Price Levels* – The prices of CO<sub>2</sub> allowances increased rapidly in the first quarter following the announcement of the planned program changes.<sup>24</sup> Prices remained at elevated levels near \$3.50 throughout the second quarter of 2013. Prices trended downward during the third quarter before stabilizing near \$2.70 in September. Prices trended upward during the fourth quarter and generally exceeded \$3.00 before the end of 2013. Volume-weighted average prices increased more than 50 percent from 2012 to 2013, and prices were more volatile in 2013 than in recent years. The second quarter of 2013 saw prices at their highest levels since the second quarter of 2009.
- *Futures Contract Prices* – These were generally consistent with the prices of physical deliveries in COATS throughout the year. The volume-weighted average futures price for all vintages and control periods reached a quarterly high of \$3.41 during the second quarter. For the full year in 2013, the average futures price increased 53 percent to \$3.03. Some of the transaction prices reported in COATS are associated with physical deliveries that result from the expiration of a futures contract<sup>25</sup>
- *Physical Deliveries in COATS* – The volume-weighted average transaction price for all vintages and control period CO<sub>2</sub> allowances increased 57 percent from \$1.99 in 2012 to \$3.12 in 2013. The average price of transactions ranged from a low of \$1.93 during the last week of January to a high of \$3.70 in mid-April, and generally moved consistently with the levels of futures and auctions prices throughout the year.
- *Auction Clearing Prices* – The average auction clearing price increased 51 percent from \$1.93 in 2012 to \$2.92 in 2013. Auctions had cleared at the reserve price in each of the ten quarterly auctions prior to 2013, but prices rose at the start of the year after the announcement of the planned program changes. Similar to futures contract prices and CO<sub>2</sub> allowance transfers in COATS, auction prices peaked in the second quarter, when Auction 20 cleared at \$3.21 on June 5.

## **B. Volatility of CO<sub>2</sub> Allowance Prices**

Cap-and-trade markets are designed to give firms efficient incentives to reduce or offset emissions. In the short-term, high-emitting generators will operate less frequently in favor of

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<sup>24</sup> The new emissions cap and other updates to the Model Rule were announced on February 7, 2013. See [http://www.rggi.org/docs/PressReleases/PR130207\\_ModelRule.pdf](http://www.rggi.org/docs/PressReleases/PR130207_ModelRule.pdf). Subsequently, each of the Participating States revised its CO<sub>2</sub> Budget Trading Program to be consistent with the updated Model Rule. See [http://www.rggi.org/docs/PressReleases/PR011314\\_AuctionNotice23.pdf](http://www.rggi.org/docs/PressReleases/PR011314_AuctionNotice23.pdf).

<sup>25</sup> Several business days after a contract reaches expiration, CO<sub>2</sub> allowances are exchanged for funds according to the closing price on the last day before expiration. Accordingly, the transaction prices recorded in COATS are expected to be consistent with the prices of futures and forward contracts in the previous week.

low-emitting generators. In the long-term, the market will affect the decisions of firms to develop offset projects, retire older inefficient generation, and perform maintenance that increases fuel efficiency and lowers carbon-intensity. Predictable CO<sub>2</sub> allowance prices decrease the risks associated with making long-term investments in reducing CO<sub>2</sub> emissions. Since CO<sub>2</sub> allowance prices can be volatile, the availability of futures and options contracts allows firms to protect themselves from the risks of such investments.

One measure of the volatility of CO<sub>2</sub> allowance prices is known as *historic volatility*,<sup>26</sup> which is a measure of volatility based on day-to-day price variations over a recent period (e.g., several months or one year). This is a useful measure when factors influencing the volatility of prices in the recent period are likely to be the same as the factors influencing the volatility of prices in the future.

Observations regarding historic volatility of CO<sub>2</sub> allowance prices:

- *Historic Volatility Trends* – Futures prices became more volatile in 2013 as compared to previous years. The historic volatility of futures prices fell from 16 percent in 2010 to 9 percent in 2011 to 5 percent in 2012, before rising to 35 percent in 2013. The volatility of futures prices in 2013 was similar to levels seen at the start of the market in 2008 and 2009.
- *CO<sub>2</sub> Emissions Cap and Price Volatility* – Historic volatility was very low from 2010 to 2012 because there was a substantial surplus of CO<sub>2</sub> allowances and prices remained very close to the auction reserve price, which functions as a price floor since allowances are never sold for less than the auction reserve price. Volatility increased in 2013 following the announcement of planned changes following the 2012 Program Review, including a 45 percent reduction in the annual CO<sub>2</sub> emissions cap.

Another measure of the volatility of CO<sub>2</sub> allowance prices is known as *option-implied volatility*,<sup>27</sup> which measures the volatility that is implied by the trading of option contracts for

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<sup>26</sup> Historic volatility is a measure of the standard deviation of the day-over-day percentage change in price. Volatility is normally expressed as an estimated standard deviation for a one year period, even if it is calculated from a shorter period of time.

<sup>27</sup> The option-implied volatility of a CO<sub>2</sub> allowance refers to the expected standard deviation of the distribution of allowance prices one year in the future. For example, if the expected value of the price one year in the future is

CO<sub>2</sub> allowances. If a firm perceives that CO<sub>2</sub> allowance prices are volatile, the firm may be willing to pay a high price for an option contract that protects it from unforeseen allowance price fluctuations. Likewise, if a firm perceives that CO<sub>2</sub> allowance prices are relatively stable, the firm will be willing to pay relatively little for the same option contract.<sup>28</sup>

The following scatter plot reports the option-implied (i.e., expected) volatility of RGGI CO<sub>2</sub> allowance futures contracts, which can be inferred from the trading of options contracts in 2013.<sup>29</sup> The vertical axis shows the option-implied (expected) volatility of CO<sub>2</sub> allowance futures prices, and the horizontal axis shows the trade date. The figure excludes contracts if fewer than two auctions occurred between the trade date and the expiration date. This is because historical pricing patterns suggest that CO<sub>2</sub> allowance prices become more volatile around the time of each quarterly auction. Therefore, excluding contracts with short times to maturity reduces variations in implied volatility that are driven by the timing of the trades within a particular quarter.

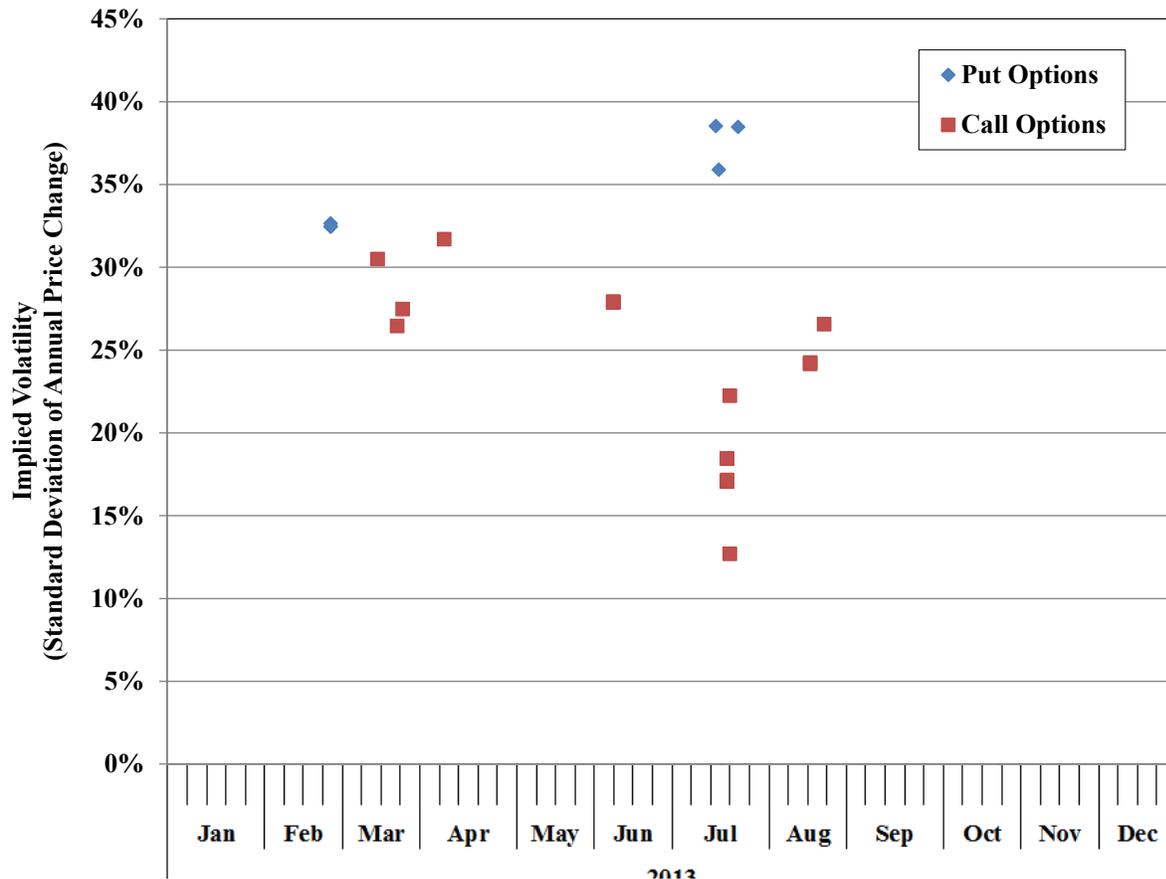
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\$1 and the option-implied volatility is 25 percent, this implies that the probability that the price will be within 25 percent of \$1 (i.e., between \$0.75 and \$1.25) is 68.2 percent assuming that the price is distributed log-normally.

<sup>28</sup> The price of an option contract depends primarily on two factors: (i) the expected value of a CO<sub>2</sub> allowance relative to the strike price of the option, and (ii) the expected volatility of an allowance over the period until the expiration date. When call option prices and put option prices move in opposite directions, it signals a change in the expected price of allowances. Conversely, when call option prices and put option prices move in the same direction, it signals a change in the expected volatility of allowance prices.

<sup>29</sup> Black's model for valuing futures options is used to estimate the option-implied volatilities of RGGI allowance futures prices.

**Figure 2: Option-Implied Volatility of CO<sub>2</sub> Allowance Futures Prices  
2013**



Observations regarding the option-implied volatility of CO<sub>2</sub> allowance prices:

- *General Patterns of Volatility* – Option-implied volatility varied considerably during the year, and it was broadly consistent with historic volatility during 2013. Both volatility metrics reflect that there was increased uncertainty regarding the value of CO<sub>2</sub> allowances after the announcement of the planned program changes.
- *March and April Option Trading* – There were five trades where implied volatility ranged between 27 and 33 percent.
- *July and August Option Trading* – The option-implied volatilities were much higher for put option contracts than for call option contracts. Specifically, the implied volatility of call options ranged between 13 and 26, while the implied volatility of put options ranged between 36 and 40. Call options generally protect the holder in the event of a price increase, while put options protect the holder in the event of a price decrease. Therefore, the option trading during the third quarter suggests that market participants anticipated

more risk of an unexpected decline in CO<sub>2</sub> allowance prices than from an unexpected price increase.

#### IV. TRADING AND ACQUISITION OF CO<sub>2</sub> ALLOWANCES

This section evaluates the trading and acquisition of CO<sub>2</sub> allowances in the primary and secondary allowance markets. Firms initially acquire CO<sub>2</sub> allowances in the primary market, mainly by purchasing them in the quarterly auctions. Firms then buy and sell CO<sub>2</sub> allowances in the secondary market. Secondary market activity can be observed from information about the trading of futures and options contracts on public exchanges and in the OTC market as well as from the transfers of ownership recorded in COATS. This section analyzes the movement of CO<sub>2</sub> allowances from their initial introduction to the market and in the secondary market.

The figures in this section evaluate the activity of firms in the CO<sub>2</sub> allowance market in 2013, including the acquisition of allowances in the quarterly auctions and trading in the secondary market. The analyses in this section distinguish between compliance entities and investors (i.e., firms with no compliance obligations).<sup>30</sup>

Key observations regarding trading and acquisition of CO<sub>2</sub> allowances:

- *Unsold CO<sub>2</sub> Allowances* – One hundred percent of the CO<sub>2</sub> allowances offered for sale were sold in 2013, up from 59 percent in 2012. The reduction of unsold CO<sub>2</sub> allowances reflects that since announcement of the planned program changes firms have anticipated that allowance prices will remain well above the auction reserve price in the future.
- *Surplus CO<sub>2</sub> Allowances in Circulation* – The number of CO<sub>2</sub> allowances in circulation increased from 161 million at the end of 2012 to 319 million at the end of 2013. Over the same period, cumulative compliance obligations for the second control period increased from 92 million to 179 million, so the surplus number of CO<sub>2</sub> allowances increased from 69 million at the end of 2012 to 140 million at the end of 2013. As a result of the interim adjustments for banked CO<sub>2</sub> allowances (i.e., the FCPIABA and the SCPIABA), the current surplus of allowances will be depleted over the remainder of the decade.
- *Acquisition by Compliance Entities* – The share of the CO<sub>2</sub> allowances in circulation that were held by compliance entities fell from 94 percent at the end of 2012 to 76 percent by

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<sup>30</sup> In this report, the compliance entity category includes corporate affiliates of compliance entities. In some cases, a firm that does not have stock ownership in a budget source is categorized as a compliance entity if it is believed that the firm has substantial control over the operation of a budget source and/or responsibility for acquiring RGGI allowances to satisfy the owner's compliance obligations.

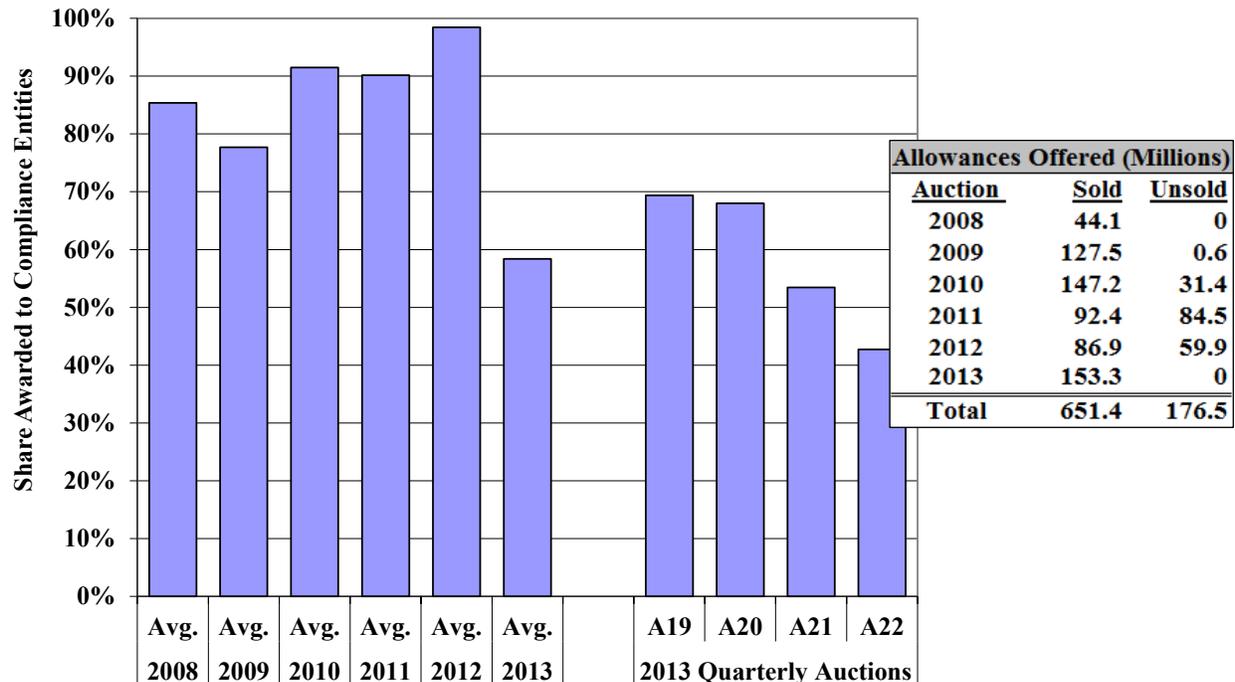
the end of 2013 as the activity of investors increased. At the end of 2013, compliance entities held 65 million of the surplus CO<sub>2</sub> allowances in circulation (46 percent).

- *Participation by Investors* – Investors purchased 42 percent of the CO<sub>2</sub> allowances offered for sale at auction during 2013 and were also active in the secondary markets, particularly in the fourth quarter. The share of CO<sub>2</sub> allowances held by investors increased from 6 percent at the beginning of 2013 to 24 percent at the end of the year. Of the 140 million surplus CO<sub>2</sub> allowances in circulation at the end of 2013, investors held approximately 75 million (54 percent). A high level of participation by investors is expected given the large current surplus of CO<sub>2</sub> allowances. Their participation is likely to reduce volatility as RGGI transitions to the new CO<sub>2</sub> emissions cap for the period from 2014 to 2020.
- *Trading Activity in the Secondary Market* – Increased uncertainty about future CO<sub>2</sub> allowance prices has led to increased trading activity, as compliance entities seek to hedge themselves and investors take more interest in the secondary markets for allowances. The volume of futures trading totaled 76 million CO<sub>2</sub> allowances in 2013 (up from just two million in 2012), while the volume of allowance transfers between unaffiliated firms in COATS totaled 50 million in 2013 (up four percent from 48 million in 2012). Sixty-three percent of the yearly volume of futures contracts and 60 percent of the yearly volume of allowance transfers in COATS occurred in the fourth quarter of 2013 as many futures contracts reached maturity (particularly at the end of December).
- *Patterns of CO<sub>2</sub> Allowance Acquisition* – Fifty percent of the CO<sub>2</sub> allowances in circulation at the end of 2013 were held by firms that had held them since the beginning of the year, 39 percent were held by firms that acquired them through auctions or state allocations during 2013, and 11 percent were held by firms that purchased them in the secondary market during 2013. Hence, the auctions are still the primary means by which firms acquire CO<sub>2</sub> allowances.

#### A. Distribution of Auction Awards

The following figure reports the quantity of CO<sub>2</sub> allowances that were offered and sold in each of the four auctions that were held in 2013 (i.e., Auctions 19 through 22) and in each year from 2008 to 2013. The bars show the percentage of CO<sub>2</sub> allowances (as a share of allowances sold) that was purchased by compliance entities in each year since 2008 and in each auction held in 2013, while the remaining share of allowances sold in each period was purchased by investors. The table in the figure shows the numbers of sold and unsold allowances in each calendar year since 2008 and in each auction held in 2013.

**Figure 3: Distribution of Auction Awards  
Auctions 19 to 22**



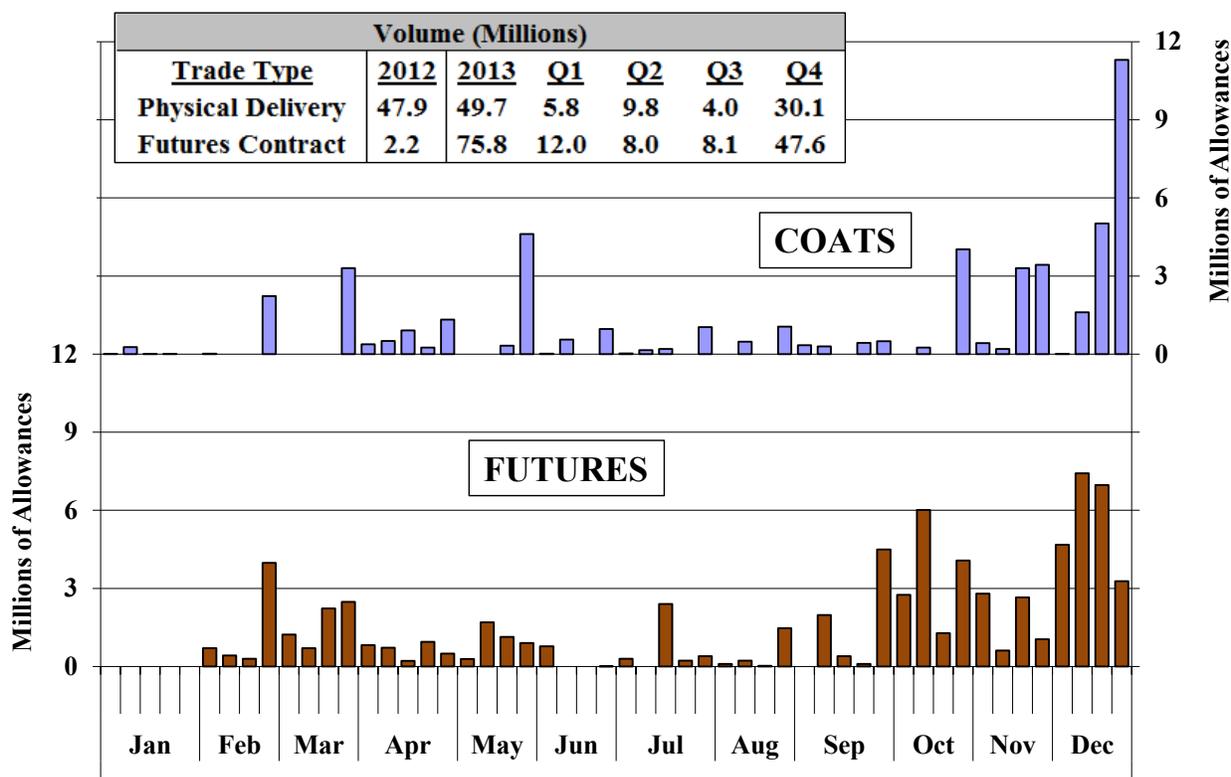
Observations regarding distribution of auction awards:

- Distribution of Auction Awards* – The share of CO<sub>2</sub> allowances purchased in the auctions by compliance entities ranged from 78 percent to 91 percent through 2011, then increased to 98 percent in 2012, before decreasing to 58 percent in 2013. The increased share of CO<sub>2</sub> allowances purchased by investors in 2013 reflects that (a) the number of allowances in circulation far exceeds the compliance obligations that compliance entities have incurred to date, but (b) the emissions cap will be tightened in a manner that reduces the number of surplus allowances in circulation over the remainder of the decade. Consequently, compliance entities do not have an incentive to hold a substantial portion of the allowances in circulation, while investors that expect allowance prices to rise in the future have an incentive to hold allowances at present.
- Unsold CO<sub>2</sub> Allowances* – None of the allowances offered for sale in 2013 went unsold. This compares to 41 percent unsold in 2012 and 48 percent unsold in 2011. The drop in unsold allowances reflects that (since the announcement that the emissions cap would be tightened) firms anticipate that allowance prices will remain well above the auction reserve price in the future.

**B. CO<sub>2</sub> Allowance Trading Volumes**

The following figure summarizes the volume of trading of futures and forward contracts on the Intercontinental Exchange (“ICE”) as well as transfers of CO<sub>2</sub> allowances between unaffiliated parties that were recorded in COATS on a weekly basis in 2013. The bottom portion of the figure is plotted against the left vertical axis, and shows the weekly volume of futures trading of CO<sub>2</sub> allowance contracts. The top portion of the figure is plotted against the right vertical axis, and shows the weekly volume of CO<sub>2</sub> allowance transfers between unaffiliated firms that are reported in COATS. The tables show year-over-year comparisons of the total volumes of futures trading and CO<sub>2</sub> allowance transfers in COATS.

**Figure 4: Volume of Trading of CO<sub>2</sub> Allowances and Allowance Futures**  
CCFE Futures and COATS Allowance Transfer Trading Volumes



Observations regarding CO<sub>2</sub> allowance trading volumes:

- *Volume of Futures Trading* – The volume of futures trading totaled 75.8 million CO<sub>2</sub> allowances in 2013, up from just 2.2 million in 2012. Sixty-three percent of the yearly volume occurred in the fourth quarter of 2013, when nearly 48 million CO<sub>2</sub> allowances were traded. Increased uncertainty about future allowance prices has led to increased

futures trading as compliance entities seek to hedge their risk and as investors take more interest in the allowance market.

- *CO<sub>2</sub> Allowance Transfers* – The volume of CO<sub>2</sub> allowance transfers between unaffiliated firms totaled 49.7 million in 2013, up four percent from 47.9 million in 2012 and 485 percent from approximately 8.5 million in 2011. The volume of transfers in 2012 was elevated as compliance entities purchased allowances in advance of the compliance deadline for the first control period in March of 2012. The volume increased again in the fourth quarter of 2013 as many futures contracts reached maturity, particularly at the end of December.

### **C. Acquisition of CO<sub>2</sub> Allowances in the Secondary Market**

This part of the section evaluates how the ownership of CO<sub>2</sub> allowances has changed as a result of trading in the secondary market.<sup>31</sup> Changes in the ownership of CO<sub>2</sub> allowances are quantified in Figure 5 using two measures: the open interest in RGGI futures contracts and the net purchases and sales of CO<sub>2</sub> allowances by individual firms.<sup>32, 33</sup>

Figure 5 summarizes net changes in ownership through the secondary market in 2013. Futures open interest is based on futures positions at the end of the last business day of each month, while net purchases and sales are based on registered holdings in COATS at the end of the last business day of each month.

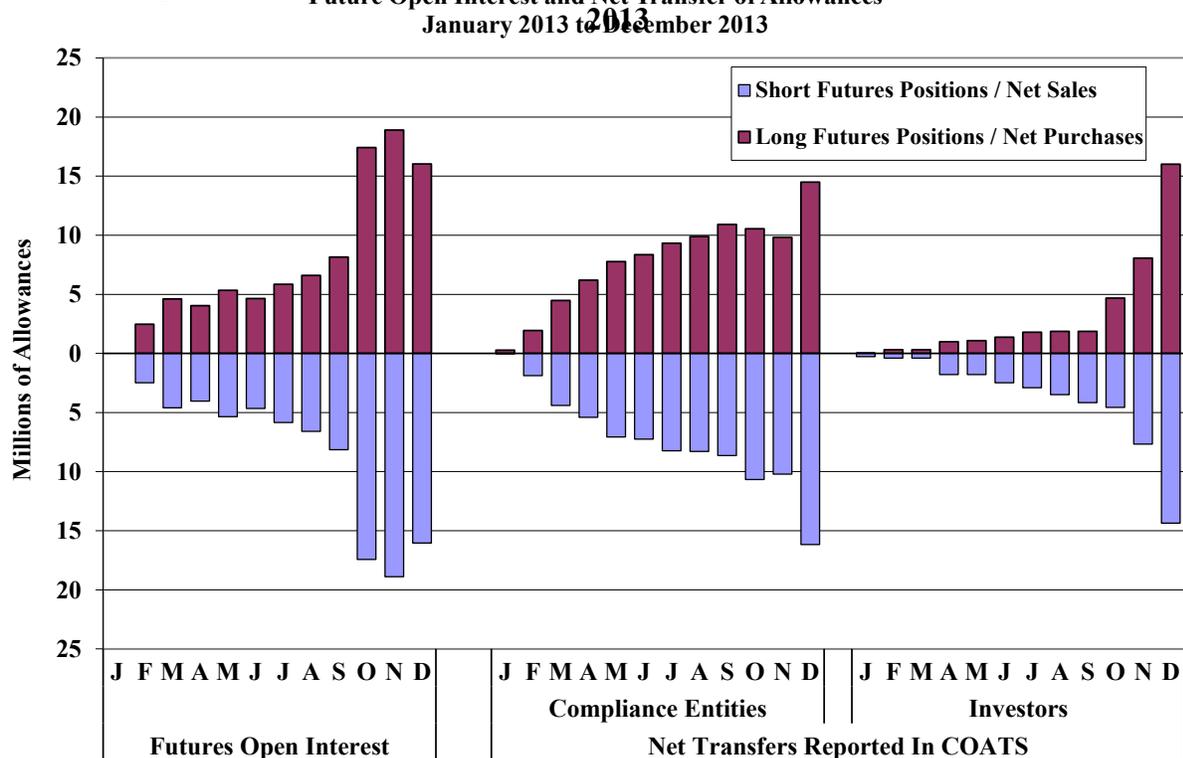
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<sup>31</sup> This excludes the majority of CO<sub>2</sub> allowances, which are held by firms that purchased them directly in the auction or received them through allocations by one of the Participating States.

<sup>32</sup> Open interest in futures contracts includes the net amount of futures contracts that have been purchased or sold on ICE by a particular firm, but that have not reached delivery. For example, if a firm sells 100 contracts to another firm, it will have an open interest, or short position, of 100 contracts. If the firm then buys 40 contracts, these will partly offset its short position, resulting in an open interest, or short position, of 60 contracts. The total open interest in the market can be determined by summing across all of the long positions of firms (or alternatively, by summing across all of the short positions). Information on the open interest in futures contracts is available on the ICE.

<sup>33</sup> Net purchases/sales of CO<sub>2</sub> allowances by a particular firm include the net change in the amount of CO<sub>2</sub> allowances in a firm's COATS account that has resulted from trading (rather than the auctions or allocations). For example, if a firm purchases 100,000 CO<sub>2</sub> allowances from another firm, and then sells 30,000 allowances, the firm's net purchase of allowances would be 70,000. The total net change in CO<sub>2</sub> allowance holdings in the market can be determined by summing the net purchase or net sales of individual firms. Information on the ownership of actual CO<sub>2</sub> allowances comes from COATS.

**Figure 5: Futures Open Interest and Net Transfers of CO<sub>2</sub> Allowances<sup>34</sup>**



Observations regarding the acquisition of CO<sub>2</sub> allowances in the secondary market:

- *Open Interest in Futures* – Open interest changed significantly during two periods in 2013. After the February announcement of plans to tighten the CO<sub>2</sub> emissions cap, open interest increased in late February and March and then generally remained flat through the third quarter. In October, open interest increased again and reached a high of nearly 19 million at the end of November. The net change in open interest of futures and forward contracts during 2013 was just over 16 million CO<sub>2</sub> allowances.
- *Net Transfers Reported by Compliance Entities* – Most transfer activity in the first three quarters of 2013 was from compliance entities using the secondary market to acquire CO<sub>2</sub> allowances that they needed to satisfy their compliance obligations. Secondary market activity increased steadily from the start of the year through the end of September of 2013 at which time compliance entities had acquired net long positions of 10.9 million CO<sub>2</sub> allowances. Net long positions then decreased to 9.8 million CO<sub>2</sub> allowances at the

<sup>34</sup> Net transfers of CO<sub>2</sub> allowances include transfers that occurred since January 1, 2013. Hence, transfers that occurred before January 1, 2013 are excluded.

end of November before jumping to 14.5 million at the end of the year. Compliance entities also steadily increased their net short positions throughout the year. Net short positions reached 10.7 million CO<sub>2</sub> allowances (slightly greater than net long positions) by the end of October, and finished the year at 16.2 million. These results indicate that some compliance entities have used the secondary market to increase their holdings while others have used the secondary market to sell surplus allowances.

- *Net Transfers Reported by Investors* – The net long positions of investors remained below 2 million CO<sub>2</sub> allowances through the end of September and then increased substantially as these firms purchased allowances in the last quarter of 2013. At the end of the year investors had net long positions of more than 16 million CO<sub>2</sub> allowances compared to net short positions of 14.4 million CO<sub>2</sub> allowances. Like compliance entities, some investors have used the secondary market to increase their holdings while other investors have used it to reduce their holdings.
- *Total Net Acquisition Reported in COATS* – The total net purchase of CO<sub>2</sub> allowances in 2013 (30.5 million) is smaller than the gross volume of transactions between unaffiliated firms (49.7 million as shown in Figure 4). This is because some firms have both purchased and sold CO<sub>2</sub> allowances in the secondary market such that the net change in their position is smaller than the total volume of their transactions. Although the total net purchase of CO<sub>2</sub> allowances was substantial, it was still much smaller than the 153 million CO<sub>2</sub> allowances that were acquired in the auctions in 2013. Hence, the auctions are still the principal means by which firms acquired CO<sub>2</sub> allowances in 2013.

#### **D. Patterns of CO<sub>2</sub> Allowance Holdings**

The following figure combines information on the acquisition of CO<sub>2</sub> allowances from the auctions and state allocations with information on the purchase and sale of allowances in the secondary market and the initial holdings of allowances on January 1, 2013. Together, this information provides a summary of the holdings of CO<sub>2</sub> allowances in COATS accounts according to whether the allowances were acquired: (i) prior to 2013, (ii) through the primary market, or (iii) through the secondary market. Figure 6 reports several categories of CO<sub>2</sub> allowances that are described below.

*Net Sales in the Secondary Market* includes CO<sub>2</sub> allowances that were held at the end of 2012, purchased in an auction in 2013, or acquired through an allocation in 2013 and then subsequently sold in the secondary market.

*Net Purchases in the Secondary Market* includes CO<sub>2</sub> allowances that were held in the COATS account of a firm that purchased them in the secondary market after January 1, 2013.

*Awards and Allocations – Retained in COATS Account* includes CO<sub>2</sub> allowances that were still held in the COATS account of the firm that purchased them in an auction or acquired them through an allocation in 2013. If a firm was a net seller of CO<sub>2</sub> allowances at any point in 2013, then the CO<sub>2</sub> allowances were first deducted from this category.

*Initial Holdings – Retained in COATS Account* includes CO<sub>2</sub> allowances that were held in the COATS account of the firm from the beginning of 2013. If a firm sold CO<sub>2</sub> allowances in 2013, those allowances were deducted from this category after any awards and allocations were exhausted.

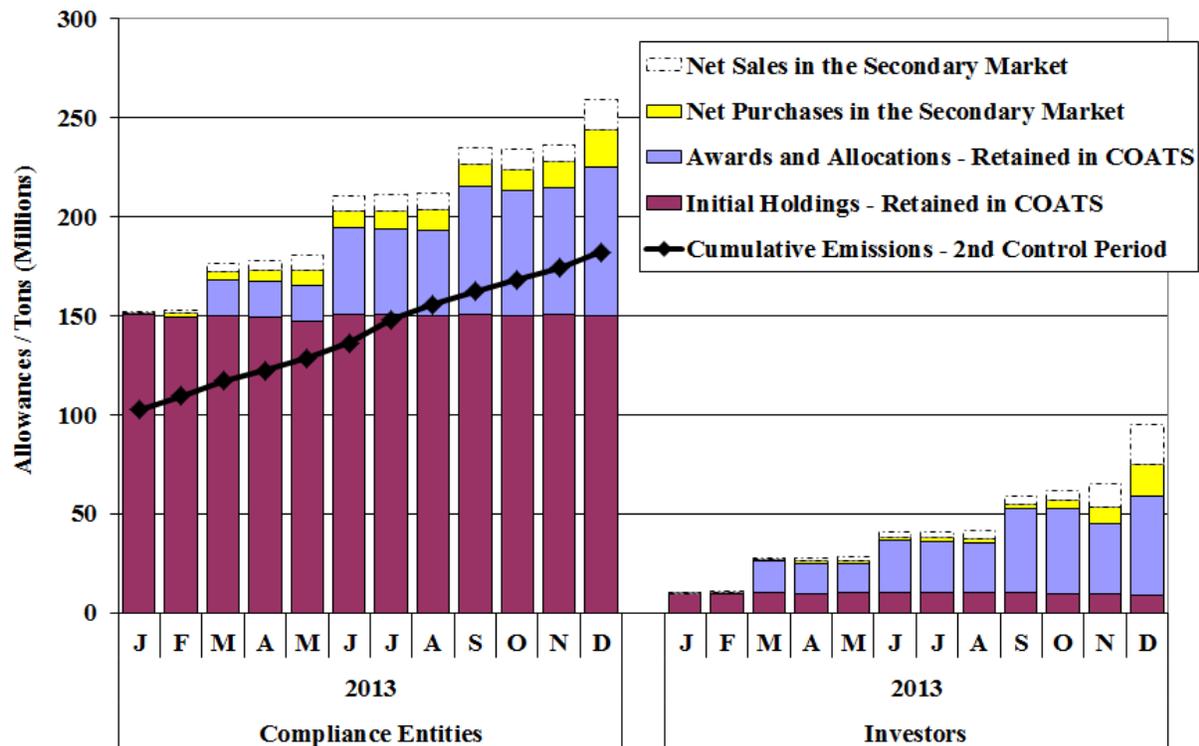
For each firm, its holdings of CO<sub>2</sub> allowances in COATS are equal to the sum of three categories: *Initial Holdings – Retained in COATS Account*, *Awards and Allocations – Retained in COATS Account*, and its *Net Purchases in Secondary Market*.<sup>35</sup> Figure 6 shows the four categories of CO<sub>2</sub> allowances at the end of each month in 2013. The figure also shows the cumulative CO<sub>2</sub> emissions for compliance entities in the second control period. The information is aggregated separately for compliance entities and for investors.

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<sup>35</sup> If a firm initially held 15,000 allowances at the beginning of the year, purchased 50,000 allowances in an auction, purchased 100,000 allowances in the secondary market, and then sold 130,000 allowances in the secondary market, the firm would contribute:

- 30,000 allowances to *Net Sales in Secondary Market*. The calculation does not consider the serial numbers of individual allowances. Hence, in the example, it would not matter whether the 130,000 allowances sold had originally been acquired in the auction or in the secondary market.
- 20,000 allowances to *Awards and Allocation – Retained in COATS Account*.
- 15,000 allowances to *Initial Holdings – Retained in COATS Account*.

**Figure 6: Sources of CO<sub>2</sub> Allowances Held in COATS Accounts  
2013**



Observations regarding registered CO<sub>2</sub> allowance holdings:

- Holdings by Compliance Entities* – One hundred and sixty-one million CO<sub>2</sub> allowances were in circulation at the beginning of January 2013. Of these, 152 million (94 percent) were held by compliance entities. Compliance entities purchased significant numbers of allowances in the quarterly auctions held in March, June, September, and December of 2013. However, the share of allowances held by compliance entities dropped to 76 percent at the end of 2013 as investors increased their participation in the quarterly auctions.
- Cumulative CO<sub>2</sub> Emissions in the Second Control Period* – Cumulative second control period CO<sub>2</sub> emissions rose from 92 million at the beginning of 2013 to 179 million at the end of 2013. Thus, the amount of surplus holdings (above the amount needed for cumulative emissions) increased from 69 million at the beginning of 2013 to 140 million at the end of 2013. Thus, there is currently a substantial surplus of allowances in circulation. As noted previously, as a result of the interim adjustments for banked CO<sub>2</sub> allowances (i.e., the FCPIABA and the SCPIABA), the current surplus of allowances will be depleted over the remainder of the decade.

- *Holdings by Investors* – The share of allowances held by investors increased from 6 percent at the beginning of 2013 to 24 percent at the end of 2013. By the end of 2013, investors held 54 percent of the surplus allowances in circulation (i.e., the portion of allowances in surplus of cumulative emissions in the second control period).

## V. PARTICIPATION IN THE CO<sub>2</sub> ALLOWANCE MARKET

This section evaluates participation by individual firms in the CO<sub>2</sub> allowance market.

Participation by many firms promotes competition and helps ensure that CO<sub>2</sub> allowance prices are determined efficiently. Over time, firms that need CO<sub>2</sub> allowances for compliance should be able to acquire them through the auctions and/or the secondary market, and the holdings of individual firms should be relatively consistent with their potential uses for allowances.

This section evaluates four aspects of the CO<sub>2</sub> allowance market that reveal the level of participation by individual firms: (i) the demand for allowances by individual firms, (ii) the breadth of participation in the quarterly auctions, (iii) the holdings of individual firms relative to their demand for allowances, and (iv) the breadth of participation in the trading of allowance futures contracts.

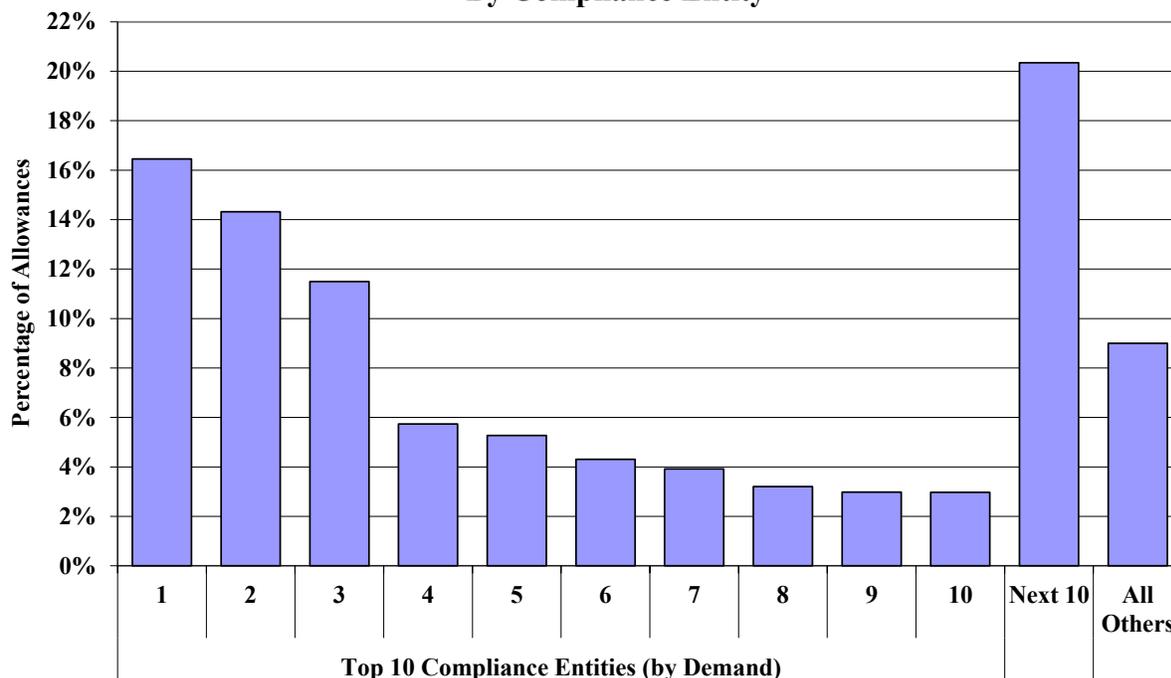
Key observations regarding participation in the CO<sub>2</sub> allowance market:

- *Demand for CO<sub>2</sub> Allowances* – The demand for CO<sub>2</sub> allowances is dispersed relatively widely across firms, inviting participation in the auctions by large number of firms. The two largest compliance entities account for a combined 31 percent of the total projected demand and the top ten compliance entities account for 71 percent. The shares have increased moderately from the estimates in 2012.
- *Participation in the Auctions* – The average number of bidders participating in 2013 auctions was 45, up 53 percent from 2012. The number of compliance entities submitting bids increased from an average of 23 in 2012 to 36 in 2013. The number of investors submitting bids increased from an average of one in 2012 to ten in 2013.
- *Distribution of CO<sub>2</sub> Allowances Awarded* – The awards in the first 22 auctions were dispersed across firms generally consistent with their demand. Aggregating across all 22 auctions, the largest number of CO<sub>2</sub> allowances awarded to a single firm went to a compliance entity that purchased nearly 17 percent of the allowances. In 2013, investors were awarded the largest number of CO<sub>2</sub> allowances in each of the four auctions.
- *Distribution of CO<sub>2</sub> Allowance Holdings* – The top 10 compliance entities accounted for 56 percent of total holdings, smaller compliance entities accounted for 21 percent, and seven investors accounted for 23 percent. These levels are consistent with competitive expectations given that the current private bank of allowances far exceeds the compliance obligations of firms thus far in the second control period.

### A. Demand for CO<sub>2</sub> Allowances

The following figure summarizes the projected demand for CO<sub>2</sub> allowances of individual compliance entities at the end of 2013. We project the demand of each compliance entity for CO<sub>2</sub> allowances based on historical CO<sub>2</sub> emissions patterns and expected changes in future market conditions. The projected demand is shown for each of the top ten compliance entities (i.e. the ten firms with the highest projected demand), the second ten compliance entities as a group, and all other compliance entities as a group. The projected demand is reported in Figure 7 as a percentage of the total projected market demand.

**Figure 7: Estimated Demand for CO<sub>2</sub> Allowances  
By Compliance Entity**



Observations regarding demand for CO<sub>2</sub> allowances:

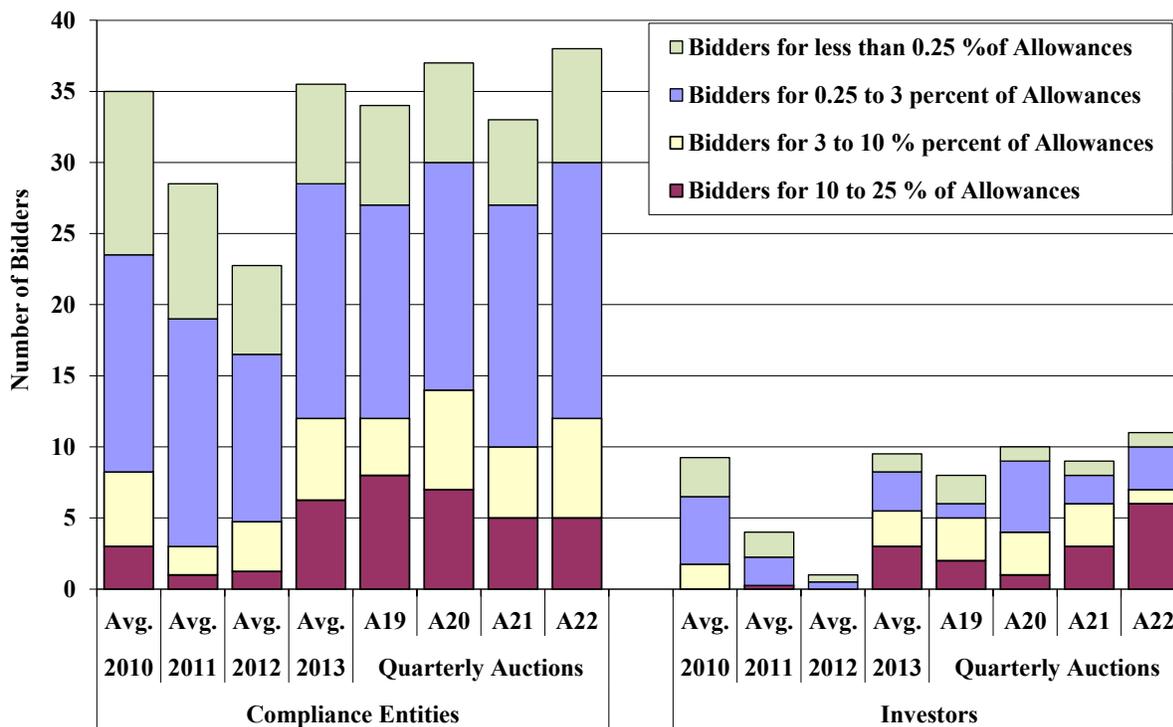
- Demand for CO<sub>2</sub> Allowances* – The demand for CO<sub>2</sub> allowances is dispersed relatively widely across firms. The two largest compliance entities account for 31 percent of the total projected demand, while the top five compliance entities account for 53 percent. The top ten compliance entities account for 71 percent of the total projected market demand, while the next ten compliance entities account for 20 percent, and all compliance entities that are not among the top 20 firms account for 9 percent.

- Concentration of Demand** – The concentration of demand for CO<sub>2</sub> allowances increased moderately from 2012 to 2013, primarily reflecting that corporate acquisitions have increased the concentration of ownership of electricity generation assets. The demand shares for the largest two compliance entities rose from 29 percent of total projected demand in the previous annual report to 31 percent in this report.

**B. Participation in RGGI Auctions**

The following figure summarizes the breadth of participation in the four auctions during 2013. The figure reports the number of firms that submitted bids in each auction. The number of bidders is shown separately based on whether the bidder was a compliance entity or an investor. The figure shows these quantities averaged across the auctions in each year from 2010 to 2013.<sup>36</sup>

**Figure 8: Number of Bidders According to the Quantity of Bids Submitted**  
 Auctions for Compliance Entities and Investors



<sup>36</sup> For example, in Auction 19, 38 million CO<sub>2</sub> allowances were offered. A firm that submitted bids for 500,000 allowances would be counted in the “C: 1% to 3%” category, since 500,000 ÷ 38 million = 1.3 percent.

Observations regarding participation in the RGGI auctions:

- *Participation by Compliance Entities and Investors* – In the 2013 auctions, the number of bidders ranged from 42 to 49 and averaged 45 firms, up 53 percent from 2012. The number of compliance entities submitting bids increased from an average of 23 in 2012 to 36 in 2013. The number of investors submitting bids increased from an average of one in 2012 to ten in 2013.
- *Participation by Large and Small Bidders* – The number of large bidders (i.e., firms submitting bids for more than three percent of the allowances in a current control period offering) increased from an average of five in 2012 to 18 in 2013. The number of small bidders (i.e., firms submitting bids for up to three percent of allowances offered for sale) increased from 19 in 2012 to 28 in 2013.
- *Competition* – Participation by a large number of firms promotes competition and helps ensure that the auction clearing price reflects the market value of CO<sub>2</sub> allowances. The increase in participation in 2013 is encouraging, and we found no material evidence of anti-competitive conduct or significant barriers to participation in our reviews of the bids and the qualification process of each auction.

### **C. Acquisition of CO<sub>2</sub> Allowances by Individual Firms**

In a well-functioning market, we expect each firm to purchase a number of CO<sub>2</sub> allowances that is generally consistent with its demand. Individual firms may purchase a larger or smaller share according to how the current price of CO<sub>2</sub> allowances compares to their expectations of allowance prices in the future. Firms that believe CO<sub>2</sub> allowances are currently undervalued can be expected to purchase a larger share, while firms that believe allowances are overvalued can be expected to purchase a smaller share. Thus, competition by many firms helps ensure that the current price of CO<sub>2</sub> allowances in the auctions and in the secondary market reflects reasonable expectations.

The following two figures examine the distribution of CO<sub>2</sub> allowances across firms following the fifth full year of the RGGI market's operation. Figure 9 illustrates how broadly CO<sub>2</sub> allowances were distributed in the auctions, while Figure 10 illustrates how the holdings of allowances in COATS accounts were distributed after the close of 2013. The figures show that CO<sub>2</sub> allowances have generally been acquired by firms in quantities that are consistent with their demand, which is a positive indicator regarding the competitiveness of the market.

Figure 9 reports the quantities of CO<sub>2</sub> allowances that were awarded to individual firms in the first 22 auctions as well as the average quantities of CO<sub>2</sub> allowances that were awarded to firms in the 2013 auctions. The awards are shown for each of the top ten compliance entities (i.e. the ten firms with the highest projected demand), all other compliance entities as a group, each of the top five other firms based on awards (i.e., the five firms with the largest total awards), and all other firms as a group. The top ten compliances entities are ranked in descending order based on total awards rather than demand.

**Figure 9: Distribution of Auction Awards  
Auctions 1 – 22**

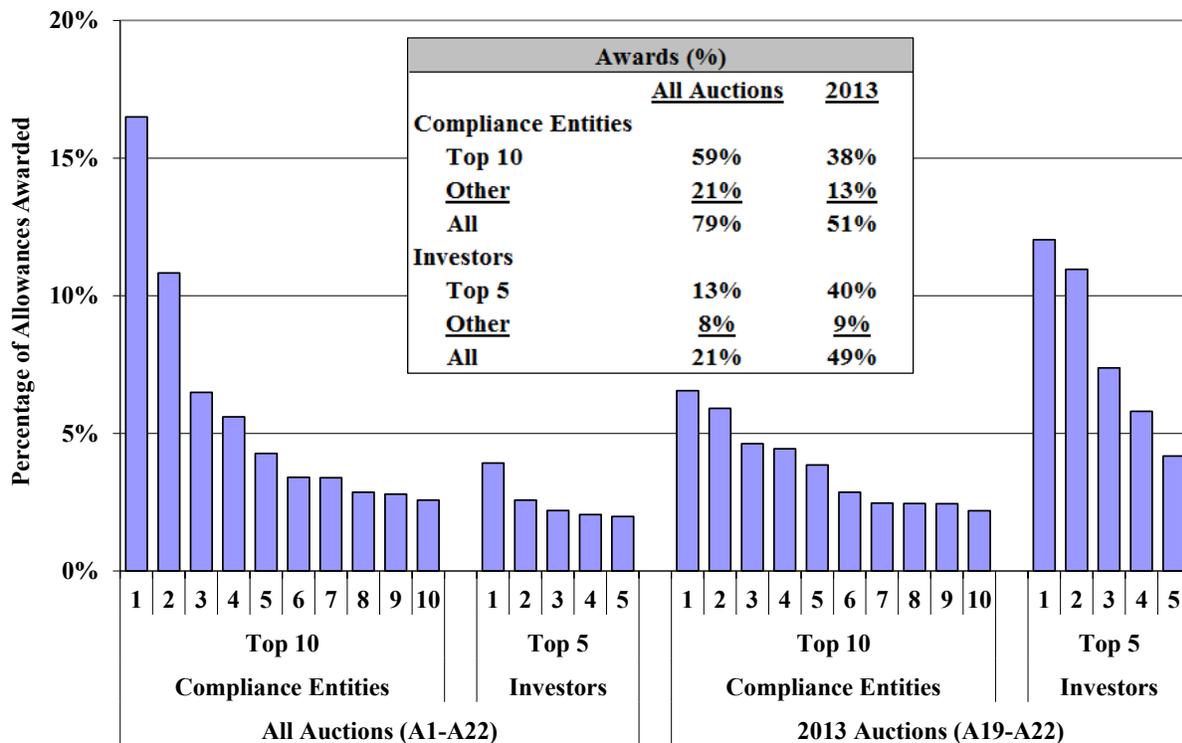
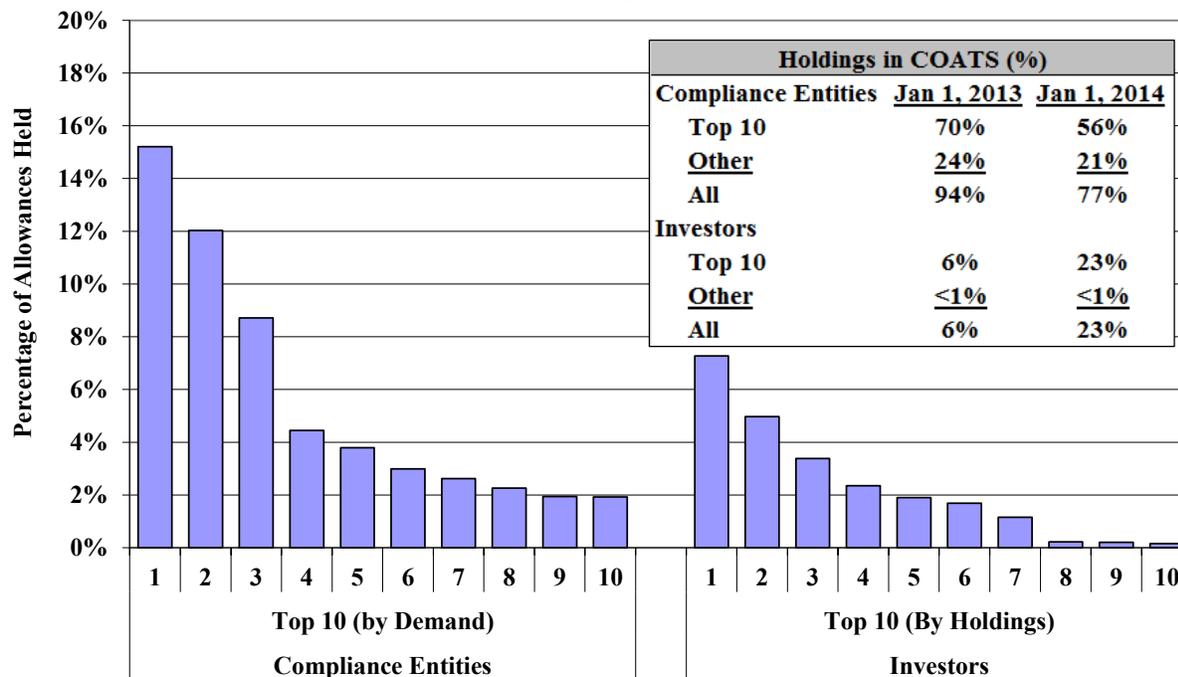


Figure 10 reports the quantities of CO<sub>2</sub> allowances that were held in the COATS accounts of individual firms at the beginning of January 2014, following the delivery of contracts for December 2013 delivery. The holdings are shown for each of the top ten compliance entities, all other compliance entities as a group, each of the top ten other firms based on holdings (i.e., the ten firms with the largest holdings registered in COATS), and all other firms as a group. The top

ten compliances entities are ranked in descending order based on total holdings rather than demand.

**Figure 10: Distribution of CO<sub>2</sub> Allowance Holdings  
January 2013**



Observations regarding the distribution of CO<sub>2</sub> allowances:

- Large Bidders* – Auction rules state that a single party or group of affiliated parties can purchase up to 25 percent of the CO<sub>2</sub> allowances offered in any given auction. One or more bidders were awarded 25 percent of the CO<sub>2</sub> allowances offered for sale in ten of the first 22 auctions and at least 15 percent in 11 of the remaining 12 auctions (the only exception is Auction 20 in June 2013, when the largest bidder was awarded just over 13 percent of the CO<sub>2</sub> allowances offered for sale).
- Distribution of CO<sub>2</sub> Allowances Awarded* – The total awards from the first 22 auctions were dispersed across firms generally consistent with the demand of those firms. Aggregating across all 22 auctions, the largest number of CO<sub>2</sub> allowances awarded to a single firm went to a compliance entity that purchased nearly 17 percent of the allowances. In 2013, investors were awarded the largest number of CO<sub>2</sub> allowances in each of the four auctions. The top ten compliance entities accounted for 59 percent of the total awards over the first 22 auctions, The top five investors accounted for 13 percent of awards over the first 22 auctions,

- *Distribution of CO<sub>2</sub> Allowance Holdings* – The holdings of CO<sub>2</sub> allowances were distributed across firms at the close of 2013 at levels that were generally less than the demand of those firms. The top 10 compliance entities accounted for 56 percent of the total holdings, and smaller compliance entities accounted for 21 percent of holdings. Seven investors accounted for 23 percent of current holdings. This level of holdings does not raise competitive concerns given that the current private bank of allowances far exceeds the compliance obligations of firms thus far in the second control period.

**D. Participation in the CO<sub>2</sub> Allowance Futures Market**

Additional information about the trading of futures, forwards, and options is available in the weekly Commitments of Traders (“COT”) reports, which are published by the Commodity Futures Trading Commission (“CFTC”)<sup>37</sup> for each week when greater than 20 firms have reportable positions.

Observations regarding the concentration of open interest in futures and options contracts by individual firms:

- *Number of Participants* – The number of participants in the market for RGGI CO<sub>2</sub> allowance derivatives increased in the fourth quarter of 2013, and the COT report was published for two weeks in November and two weeks in December. This is the first time that positions have been reported since December of 2010. For the four weeks that were reported, 20 firms had significant positions in RGGI Futures contracts.
- *Positions of Commercial Firms* – Commercial firms account for the majority of long and short positions. The shares held by Commercial firms during the fourth quarter of 2013 (over the four weeks that the report was published) ranged from 67 to 71 percent of long positions and 82 to 89 percent of short positions in the weeks when information was published.
- *Concentration of Ownership* – Many firms have open interest in RGGI CO<sub>2</sub> allowance futures and options, although a small number of firms account for a large share of the net long and short positions. The net long positions of the top four firms accounted for an average of 42 percent of the total long positions for the weeks that were published. The net

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<sup>37</sup> Each day, firms with an open interest of 25 contracts or more are required to report their positions to the CFTC. The CFTC categorizes each firm as Commercial if it engages in trading primarily to supply its own need for allowances or Non-Commercial if it trades for another purpose. Hence, compliance entities are generally designated as Commercial and non-compliance entities are frequently designated as Non-Commercial. Each Tuesday, the CFTC publishes the COT report, which is a summary of the long and short positions of participants in the market.

short positions of the top four firms also accounted for an average of 42 percent of the total short positions.

## VI. DISCUSSION OF MARKET MONITORING

As the RGGI Market Monitor, we evaluate the conduct of market participants in the auctions and in the secondary market to identify potential anti-competitive conduct. We also assess whether the auctions were administered properly by the auction administrator.

Participation in the auctions by a large number of firms promotes competition and helps ensure that the auction clearing price reflects the market value of allowances. Hence, the participation by a substantial number of firms as observed in Figure 8 is a positive indicator regarding the competitiveness of the first 22 auctions. We have found no material evidence of anti-competitive conduct or significant barriers to participation in our reviews of the bids and the qualification process for each product in each auction. We also found that the auctions were conducted in accordance with the noticed rules and bids received.

In our monitoring of the secondary market, we evaluate whether firms could potentially hoard a substantial share of the supply of allowances to influence prices or to prevent a competitor from obtaining allowances. Based on our review of the holdings of individual firms, we find no evidence that hoarding is a significant concern, and that the holdings of individual firms are generally consistent with their expected need for allowances over the current control period. Moreover, the results of Figure 10 demonstrate that the allowances are adequately distributed across the COATS accounts of individual compliance entities.

Another potential concern is that a firm expecting to purchase CO<sub>2</sub> allowances in the auction might sell a large number of futures contracts in an effort to push prices in the secondary market below the competitive level. Such a firm might profit from buying a large number of CO<sub>2</sub> allowances in the auction at a discount if the bidding in the auction were influenced by the depressed futures price. For this to be a profitable strategy, the firm would need to be able to substantially depress the futures price with a relatively small amount of sales—an amount smaller than the amount of CO<sub>2</sub> allowances it planned to buy in the auction. The best protection against this strategy is a market where other firms respond by making additional purchases.

Firms that are looking for an opportunity to reduce their short positions or to purchase CO<sub>2</sub> allowances for their future compliance needs help limit the effectiveness of a strategy to depress prices below the competitive level. Given current price levels relative to the auction reserve price, firms would have a strong incentive to make additional purchases if a firm deliberately attempted to depress the futures price.